GCC Dacotah

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U.S. Environmental Protection Agency
Region 8
Mail Code: 8LRC-IO
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Denver, CO 80202-1129

RE: Request for a Determination of Auto Shredder Residue as Non-Hazardous Secondary Materials Non-Waste Fuel under 40 CFR 241.3(b)(4)

Director Smith and LCRD team:

GCC Dacotah, Inc. (GCC) owns and operates the Portland cement manufacturing plant located at 501 North Saint Onge Street, Rapid City, South Dakota 57702 (the "Facility") in Pennington County, South Dakota (SD). GCC submits the request in accordance with 40 CFR 241.3(b)(4) for a determination that Auto Shredder Residue (ASR) described herein are non-hazardous secondary materials (NHSM) when used as a fuel in a cement kiln combustion unit at the Facility. The proposed alternative fuel stream has not been discarded or has been sufficiently processed to transform the material into a non-waste fuel as detailed in the definition of processing in 40 CFR 241.2. In addition, the proposed ASR stream satisfies the legitimacy criteria specified in 40 CFR 241.3(d)(1) or is functionally the same as comparable traditional fuels and can be determined to be a non-waste fuel based on balancing other relevant factors as provided in the letter.

DETERMINATION REQUEST CONTENT AND PROCEDURES

The proposed ASR meet NHSM criteria, as required by 40 CFR 241.3(b)(4). This determination request includes contents provided in the following subsections.

> *[The following non-hazardous secondary materials are not solid wastes when combusted…] Fuel or ingredient products that are used in a combustion unit, and are produced from the processing of discarded non-hazardous secondary materials and that meet the legitimacy criteria specified in paragraph (d)(1) of this section, with respect to fuels, and paragraph (d)(2) of this section, with respect to ingredients.*

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Facility Background and ASR As Alternative Fuel at GCC Dacotah

The Facility is classified under Standard Industrial Classification (SIC) code 3241 (Portland Cement Manufacturing).

Pennington County, South Dakota, is currently classified as attainment/unclassified for all criteria pollutants and averaging periods.[1] The Facility operates a pyroprocessing kiln system consists of dual, 4 stage preheat towers with precalciner and a rotary kiln (Unit #9 - Kiln 6 system). Under Clean Air Act (CAA) and South Dakota statute, the Facility is classified as an existing major source with respect to Prevention of Significant Deterioration (PSD) and Title V permitting requirements. The Facility operates under the Title V Air Quality Operating Permit No. 28.1121-02 renewed by the South Dakota Department of Environment and Natural Resources (DENR) on December 1, 2008 and most recently updated on June 5, 2017. The Facility is also a major source of Hazardous Air Pollutants (HAPs) and is subject to the requirements of 40 Code of Federal Regulations (CFR) Part 63 – Maximum Achievable Control Technology (MACT) Subpart LLL for the Portland Cement Manufacturing Industry. The Facility is also subject to several New Source Performance Standards (NSPS) under 40 CFR Part 60. Unit #9 is subject to NSPS Subpart F (Portland Cement manufacturing plants).

Permit 28.1121-02-07C, dated December 4, 2019, authorizes utilization of traditional fuels (coal, fuel oil, liquid fuel, petroleum coke, on-specification used oil, cellulosic biomass, and natural gas), categorical non-waste fuels (construction and demolition wood, creosote-treated railroad ties, and tire derived fuels [TDF]), and NHSM non-waste fuels in the kiln. Permit Condition #5.7 requires GCC to obtain a determination from the United States Environmental Protection Agency (U.S. EPA) prior to combusting the listed non-hazardous secondary material in Unit #9: With this determination request, GCC is planning to use ASR (Unit #9 - Rotary Kiln #6) as an alternative fuel to supplement currently used fuels.

Please note that as a part of this permit review process, U.S. EPA has already reviewed most of these details and provided few comments on August 20, 2019. There were no specific comments to ASR.[2]. Cement manufacturing is a raw material and fuel intensive industry. Cement is produced from various naturally abundant raw materials, including limestone, shale, clay, silica sand, and/or other additives. The raw materials contribute the major chemical constituents of calcium, silica, alumina and iron necessary to manufacture clinker, the principal ingredient in cement. Minor constituents, generally in a total amount of less than 5% by weight of the mixture, include magnesium, sulfur, sodium and potassium. Also, due to the raw materials originating from the earth's crust, a wide variety of trace elements can be found in the cement (generally totaling less than 1% by weight of the mixture). The cement clinker is ground with gypsum and smaller amounts of other ingredients to create the final Portland cement product.

The critical process involved in the Portland cement manufacturing occurs in the cement kiln system, where large volumes of fuel are needed to raise the process (raw material) temperature in the kiln system to over 2,600°F to achieve the required chemical reactions to produce clinker. The materials are continuously and slowly moved to the lower end of the kiln system in a countercurrent flow to fuels and combustion gases by rotation of the kiln. As raw materials move down the kiln they are changed to cementitious or hydraulic minerals as a result of the increasing temperature within the kiln. Heating the raw materials requires flame temperatures as high as 3,500°F. The sintering (or clinkering) zone nearest the flame in the rotary kiln has the highest temperatures, typically in the range of 2,800°F-3,200°F. These temperatures, plus residence times of the combustion gases in excess of 2 seconds, provide for nearly complete destruction of organic components while providing the necessary heat input. Inorganic components of the fuels that do not burn, are incorporated into the clinker or captured in the kiln system particulate air pollution control device (e.g., baghouse or electrostatic precipitator). The process is highly efficient in recovering heat from the fuels to make the product clinker.

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[1] U.S. EPA Green Book - https://www.epa.gov/green-book. Per §40 CFR 81.306. Accessed April 2020.

[2] U.S. EPA's comments on Permit 28.1121-02-07C, submitted to DENR on August 20, 2019.

The traditional fuels used in Unit #9 are coal, coke, natural gas, with the ability to utilize other traditional fuels such as wood, other cellulosic materials, and other liquid petroleum sources as listed in the Permit 28.1121-02-07C. The use of alternative fuels has increased considerably in the last 3 decades for use as a replacement, or partial replacement of traditional fuels, particularly within the European Union where the established fuel substitution rate is 44%.[3] Within the United States, the average fuel substitution rate is roughly 15%[4], though some plants have been able to replace fossil fuels in substantial amounts, suggesting that there is considerable opportunity to increase alternative fuel use.

The large growth in the use of alternative fuels in the cement industry, both nationally and internationally, is driven by several factors. First, cement kilns are uniquely suited to adaptively and beneficially use energy-bearing alternative fuels as part of their fuel mix, due to the large amount of energy needed to heat raw materials, the need for consistently high heating temperatures within the kiln system, and the kiln system's combustion efficiency. These characteristics, plus the industry's core focus of producing a quality product, ensure that the purpose of any fuels used as energy inputs go toward manufacturing a product, not simply destruction of wastes materials or contaminants. In addition, transitioning from fossil fuels to alternative fuels provides one of the key opportunities available to cement plants to continue sustainability improvement efforts. Indeed, the International Energy Agency has concluded that "the use of alternative fuels in cement production must more than double by 2030 to meet its sustainable development scenarios." [5]

In short, the beneficial use of ASR as alternative fuel source is well document in the cement industry. ASR was identified as an "emerging material" by U.S. EPA and the PCA E&E Committee Alternative Fuels and Raw Materials (AFR) subcommittee.[6] ASR contains the plastic and other non-metallic materials left after scrap automobiles are shredded, with about 5 million tons of ASR generated annually according to the Argonne National Laboratory in 2003. There has been previous research by automobile manufacturers, automobile recyclers, and the PCA regarding the use of ASR (or "vehicle fluff") as an AF in cement kilns. For many years, cement companies have utilized a range of alternative fuels as legitimate NHSM fuels providing meaningful heat value in the production of Portland cement.

To support GCC's efforts to further expand its use of these valuable, sustainable alternative sources, GCC submits this request for an U.S. EPA determination that the ASR are legitimate NHSM under 40 CFR 241.4(a). In general, auto shredder residue may be referred to in other literature as ASR, auto fluff, or auto shredder fluff, or other terms. ASR proposed to be used at Unit #9 is "processed" sufficiently and meet the following "legitimacy criteria" set forth in 40 CFR 241.3(d)(1) to receive an NHSM determination:

- ASR is managed as a valuable commodity.
- ASR has meaningful heating value of no less than 5,000 British thermal units per pound (BTU/lb).
- ASR contains contaminants at levels comparable in concentration to or lower than those in traditional fuels which the kiln system is designed to burn.

Historically, auto shredder residue's high content of non-ferrous metals and contaminants rendered it unusable as a commodity. Recently however, technological advancement and investment in advanced processing systems have shown to have economic benefit by separation of auto shredder residue into many valuable co-products, including non-ferrous metals.[7] Much of the motivation to develop technology that improves the rate of recycling has been driven by a directive from the European Union's Parliament that directs Member States to ensure 95% of reuse and recovery and 85% of reuse and recycling in end-of-life vehicles by 1 January 2015.[8] Removal of contaminants at the first stages of the auto recycling process and followed by efficient separation of components in auto shredder residue and removal of metal

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[3] IFC, *Increasing The Use Of Alternative Fuels At Cement Plants: International Best Practice (2017).*
[4] PCA, *2017 U.S. Labor-Energy Input Survey (2019)*
[5] IEA, *Technology Roadmap - Low-Carbon Transition in the Cement Industry* (2018).
[6] EPA. 2008. "Cement Sector Trends in Beneficial use of Alternative Fuels and Raw Materials."
[7] Krehla, Stephen "The Next Generation" *Recycling Today,* January 7, 2013.
[8] Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of-life vehicles, Article 7.

contaminants in the small fraction has led to the recognition that auto shredder residue can be a source of recyclable plastics or as a fuel in cement kilns.[9,10] Auto shredder residue constitutes the 20 to 25 percent of materials remaining after vehicles, appliances and similar durable goods have been shredded and removed of reusable parts and metals.

1. Auto shredder residue is derived from the processing of whole automobiles, appliances and similar durable goods into beneficially-reusable raw materials. Auto shredder residue is composed of plastics, rubber, foam, paper, fabric, and may contain some residual metal pieces, glass, sand, and dirt[11,12,13] (U.S. EPA, 2008; USCAR, 2008; Nourreddine, 2007). Approximately 20 to 50 percent of unprocessed dry auto shredder residue is combustible, including plastics, fabric, and rubber. Incombustible components include metals, glass, dirt, and ash.[14]
2. Without processing, auto shredder residue would have limited value as fuel, due to its high ash content, the presence of contaminants (including heavy metals, chlorine, and PCBs), and the high content of incombustibles. Unprocessed auto shredder residue has an estimated heating value of roughly 5,000 Btu/lb and is made up of about 30% polymers (by weight), 10% residual metals, 5% foam, and the remainder is a mix of glass, wood, paper, sand, dirt, rocks, and automotive fluids.[15] Prior to use as a fuel, auto shredder residue requires significant separation and processing to isolate the combustible materials with low ash content and low contaminant concentrations.

3. ASR Fuel supplies beneficial fuel value by replacing fossil fuels in GCC's Combustion Facility. After processing, auto shredder residue has a heat value comparable to traditional fuels and contains noncombustible components that are comparable to traditional fuels. ASR Fuel has no negative impact on the cement manufacturing process and is introduced into the cement manufacturing process in the manner of a bulk solid fuel.

Description of Determination Request

GCC requests a determination that ASRs are non-hazardous secondary materials that are not solid wastes when used as a fuel in a combustion unit at the Facility. This document demonstrates that the auto shredder residue produced by Pacific Steel and Recycling ("Generator") to be utilized as an alternative fuel by GCC at its Rapid City, South Dakota cement kiln (the "Combustion Facility") meets the definition of NHSM fuel as described at 40 CFR 241.

ASR Fuel is produced entirely at the Generator facility. Transportation from the Generator, handling from the Generator facility to the Combustion Facility, final sizing, blending, and delivery to the Combustion Facility will be managed by a GCC affiliate (the "Fuel Manager") which is also a subsidiary of GCC's parent company.

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[9] Havlik, Tomas "Recycling of automotive shredder residue by granulometric separation" *MM Science Journal"* June, 2017, pp. 1810-1813.

[10] Cooper, Savannah "Recycling Auto Shredder Residue" *Waste Advantage,* September 23, 2014.

[11] United States Environmental Protection Agency (EPA), 2011, Materials Characterization Paper in support of the Final Rulemaking: Identification of Nonhazardous Secondary Materials that are Solid Waste, Auto Shredder Residue.

[12] Nourreddine, Menad. 2007. "Recycling of Auto Shredder Residue." Journal of Hazardous Materials 139(3): 481-490.

[13] United States Council for Automotive Research, 2008. DID YOU KNOW THAT CARS ARE THE MOST RECYCLED PRODUCT IN AMERICA? USCAR's Vehicle Recycling Partnership Shares Green Message at 2008 NAIAS. Press Release. 1/14/2008

[14] United States Environmental Protection Agency (EPA), 2011, Materials Characterization Paper in support of the Final Rulemaking: Identification of Nonhazardous Secondary Materials that are Solid Waste, Auto Shredder Residue.

[15] Boughton, Robert. 2006. "Evaluation of shredder residue as cement manufacturing feedstock."

California Department of Toxic Substances Control.

Justification for An Approval of the Proposed Determination Request

Need for Proposed ASR as Alternative Fuel

GCC's request for this ASR specific non-waste determination of non-hazardous secondary materials to be used as fuels coincides with the sustainable manufacturing objectives promoted by U.S. EPA to benefit the environment.[16] Energy recovery of alternative fuels conserves natural resources while minimizing negative environmental impacts. Despite sustainable manufacturing practices, manufacturers generate waste streams which are not recyclable or are not *economically* recyclable, and are therefore placed into landfills. Placement of such materials into landfills ignores the substantial value the materials offer as commodity fuels, particularly where the fuels can be used in a manufacturing process that maximizes industrial heat value while simultaneously destroying contaminants as is the case in the Portland cement industry.[17]

U.S. EPA has acknowledged key benefits of alternative fuel:

> *…both greenhouse gas (GHG) and particulate matter (PM) emissions have been reduced as a co-benefit of the use of secondary materials. The use of secondary materials, such as use as a fuel in industrial processes may also result in other benefits. These may include reduced fuel imports, reducing negative environmental impacts caused by previous dumping (e.g., tires), and reduced methane gas generation from landfills*.[18]

Furthermore, in regard to the benefits of use of secondary materials as an effective substitute or supplement for primary materials, U.S. EPA has stated:

> *…monetary savings resulting from reduced resources would, theoretically, be applied to a higher and better use in the economy. This helps advance economic growth as a result of improved industrial efficiency, which, in turn, helps move the country toward material sustainability and energy self-sufficiency, while protecting human health and the environment.*[18]

Justification for Proposed Determination Request

Processing Criteria

The Generator's materials handling and processing steps described in this section show that this ASR Fuel meets definition of *processing* in 40 CFR §241.2.

The Facility must adequately "process" discarded NHSMs. The definition of "processing" is critical to this determination and is provided below, as defined at 40 CFR 241.2:

Processing means any operations that transform discarded non-hazardous secondary material into a non-waste fuel …. Processing includes, but is not limited to, operations necessary to: Remove or destroy contaminants; significantly improve the fuel characteristics of the material, e.g., sizing or drying the material in combination with other operations; chemically improve the as-fired energy content; or improve the ingredient characteristics. Minimal operations that result only in modifying the size of the material by shredding do not constitute processing for purposes of this definition.

The Generator has established quality assurance and quality control procedures throughout the processes of generation, beneficiation, material management and final processing to assure that ASR Fuel is treated as a product versus solid waste in accordance with 40 CFR §241.3(c)(1)(i).

A. SOURCE CONTROL: Whole automobiles and similar materials are received by the Generator from contracted commercial sources who are subject to rigid material acceptance standards to exclude:

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[16] https://www.epa.gov/sustainability/sustainable-manufacturing

[17] ICF, EPA, 2008. *Cement Sector Trends in Beneficial Use of Alternative Fuels and Raw Materials*, ICF International, Washington, DC.

[18] 75 FR 31849, June 4, 2010

- Radioactive materials
- Explosive materials and live munitions
- Biohazards, chemicals, and hazardous waste
- Ballasts, transformers or capacitors without non-PCB label
- Pressurized gas cylinders or sealed containers
- Tanks or drums without empty-tank certification
- Yard wastes
- Flammable liquids
- Mercury
- Asbestos

Loads containing any of these prohibited items are rejected. The Generator conducts regular audits of commercial sources to assure continued compliance. The Generator may also collect whole automobiles on its own from salvage yards using its own equipment and trained staff.

B. RECEIPT OF MATERIALS: Materials are received by truck or by rail at the Generator facility. Material receipts are managed by trained personnel. Incoming materials undergo visual screening for items prohibited by material acceptance standards and undergo radiation screening using stationary and hand-held radiation detectors. Radiation detectors are source-tested on a regular schedule.

1. REMOVAL OF CONTAMINANTS: Liquids such as washer fluid, brake fluid, antifreeze, gasoline, diesel fuel, and lubricating oil are evacuated mechanically from whole automobiles. Evacuated liquids are isolated for recycling using commercial liquid recovery equipment. Clean fuel recovered from automobiles may be reused directly by the Generator. Refrigerants are evacuated in a designated facility. Lead-acid batteries are removed and sent to an outside recycling facility. Mercury-containing devices such as mercury switches are removed manually by trained personnel. The Generator maintains a database that lists mercury-containing devices in automobiles by make and model.

2. INITIAL PROCESSING OF WHOLE AUTOS: Whole autos are conveyor-fed into shredding machines that reduce materials to a particle size that can facilitate efficient separation. A final screening for radioactive materials is made at the point of size reduction using cross-belt radiation detectors. Size reduction is followed by magnetic separation to remove ferrous metals from nonmetallic and nonferrous material. The non-metallic, non-ferrous portion is screened by size. Larger material undergoes additional size reduction by shredding. Size reduction and consistency in particle size assure efficient separation into components of non-ferrous material.

3. PROCESSING OF NON-FERROUS MATERIALS TO ISOLATE AUTO SHREDDER RESIDUE FUEL: Non-ferrous material remaining after magnetic separation undergoes further beneficiation into multiple reusable products using eddy-current induction separation and air induction separation processes. Mechanical feed systems deliver a uniform, thin, consistent material flow to maximize efficiency of eddy-current and sensor-based separation. Non-ferrous metals are removed and separated according to metal type. Non-ferrous metals are sold as recycled metals. Non-metallic components are further separated using air induction separation to create two more products, ASR Fuel and ferritic dirt. Ferritic dirt is a fine dirt-like material

with ferromagnetic properties. Removal of fine material in the range of < 1 mm has been shown to remove components with high content of metals.[19]

4. FINAL PROCESSING BY THE FUEL MANAGER: Processing of the ASR Fuel after leaving the Generator facility is limited to simple size reduction, as may be necessary to meet particle size requirements for fuel feed equipment design. Sieve analysis at the combustion facility is used to determine the need for final processing. Processing consists of shredding and screening using conventional shredding equipment.

ASR Fuel meets the requirement of sufficient processing as supported by process descriptions used in the non-waste determination for processed oil filter fluff [20] based on contaminant removal and sufficient processing. The treatment of ASR Fuel by the Generator is also similar to requirements for positive and negative sorting, and training in the Categorical Exclusion for C&D wood processed from C&D debris.[21] The materials used to produce auto shredder residue are under rigid source control. Materials reception protocols include mechanical and visual examination to reinforce materials exclusion. Contaminants are removed by mechanical and manual means prior to processing. Auto shredder residue is prepared for fuel use by separation and processing to isolate the combustible materials with low ash content and low contaminant concentrations. Initial processing is done by the Generator using a combination of mechanical sorting by size and magnetic separation. Subsequent processing by the Generator includes density separation, eddy-current separation, air induction separation, and magnetic separation which is designed to further remove incombustible components of the auto shredder residue stream. The result is a mixture of auto shredder residue that maximizes energy content while minimizing content of ash, chlorine and heavy metals. Processing of the auto shredder residue typically achieves a mixture that represents approximately 30 to 50 percent of the non-ferrous portion of unprocessed auto shredder residue, with an energy content at or above 10,000 Btu/lb. Removal of fines at the final stages of the cleaning process effectively reduces the content of metal contaminants and metals, such as copper that may be detrimental to the cement manufacturing process.[22]

Legitimacy Criteria

In accordance with 40 CFR 241.4(b)(1)(iv), the ASR waste stream proposed for the non-waste determination must meet the three (3) legitimacy criteria as defined in 40 CFR 241.3(d)(1) or must justify not meeting one or more of the criteria with other relevant factors. The legitimacy criteria and justification for each fuel category is discussed in the subsequent sections.

<u>Legitimacy Criteria 1 – Managed as a Valuable Commodity – 40 CFR 241.3(d)(1)(i)</u>

Management occurs from origination to delivery under a contractual relationship between the generator of the secondary material and/or their post-production handler and the Facility, similar to the established collection programs used in the scrap tire markets. The agreement may also be in the form of an executed purchase order. Receiving facilities have programs in place (e.g. acceptance procedures, inbound inspections, etc.) to ensure that only the appropriate materials are included in the shipment. ASR Fuel is managed as a valuable commodity. All phases of transfer, storage, handling and management from the Generator to the point of combustion at the Combustion Facility in meet the requirements of 40 CFR §241.3(d)(1)(i).

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[19] Havlik, Tomas "Recycling of automotive shredder residue by granulometric separation" *MM Science Journal"* June, 2017, pp. 1810-1813.

[20] United States Environmental Protection Agency (EPA), 2011-06-30 "Waste Determination For Oil Filter Fluff That Is Burned In Combustion Units" letter to Trendgreen Associates.

[21] 40 CFR §241.4(a)(5)(i), (ii) and (iii).

[22] Havlik, Tomas "Recycling of automotive shredder residue by granulometric separation" *MM Science Journal"* June, 2017, pp. 1810-1813.

ASR Fuel is not accumulated in any significant quantity or for any significant period of time at the Generator facility. Typical storage time is less than one month from the time of generation to the time the ASR Fuel is distributed. ASR Fuel is transported from the Generator to the Fuel Manager's facility in covered trucks with dump trailers or walking floor trailers. Incoming material is weighed, and weights are compared to weights on the bill of lading. Material is accounted for in accordance with inventory management practices established for other bulk solid fuel and raw material. Inventory is valued on a first-in-first-out basis. Inventories commonly contain a supply sufficient for one to two weeks of operation. In instances where the Combustion Facility is not operating, for example during planned outages, ASR Fuel may be stored at the Fuel Manager facility for 30-90 days, but in no case longer than one year.

ASR Fuel will be transferred by truck or conveyor to the Combustion Facility. ASR inventories at the Combustion Facility commonly contain a supply sufficient for one to two weeks of operation. In instances where the Combustion Facility is not operating, for example during planned outages, ASR Fuel may be stored for a longer period of time, but in no case longer than one year. Inventory time frames are comparable to the time frame in U.S. EPA's speculative accumulation concept in RCRA and is consistent with GCC's solid traditional fuels inventory management time frames

In accordance with 40 CFR §241.3(d)(1)(B) and (C) ASR Fuel is handled in a manner similar to that for traditional solid fuel to prevent releases to air, water or land.

TCLP analyses show that VOC, SVOC, PCB, and metal leachates from ASR fuel are well below RCRA limits and well below typical values for traditional solid fuels. Quarterly third-party sampling and testing are conducted at the Generator Facility and results are reported. Risk of airborne releases is similar to the risk of airborne releases from traditional solid fuel with mixed particle size.

At the Generator facility, auto shredder residue production, transfer, storage, and loading is conducted in a way that minimizes air-borne and water-borne dispersion. Trucks transporting auto shredder residue are covered to prevent airborne releases. During processing, airborne releases are controlled by enclosed process equipment or with water mist. Rainwater releases are controlled in accordance with a storm water management plan. The generator site is designed as a zero-discharge facility and requires no NPDES permit. Fugitive air emissions are governed by Title V air permit requirements, with controls similar to traditional solid fuels.

At the Fuel Manager and Combustion Facilities, rainwater releases from the ASR Fuel management areas are controlled in accordance with Storm Water Management Plans and regulated under an NPDES storm water permit. Fugitive air emissions are governed by the Title V air permit requirements or minor source air permit requirements as appropriate. Air emissions controls comparable to controls used for traditional solid fuels are in place.

Legitimacy Criteria 2 – Heating Value – 40 CFR 241.3(d)(1)(ii)

The U.S. EPA states that for meaningful heating value, 5,000 Btu per pound (Btu/lb) as burned is automatically considered valid energy recovery (e.g., meaningful heating value) as addressed in the NHSM criteria, where an alternative fuel with a heat content greater than or equal to 5,000 Btu/lb is presumed to be used for legitimate energy recovery.[23,24] Calorimetry of ASR Fuel samples show that ASR Fuel has gross heating values in the range of 10,000 to 13,500 Btu/lb on an as-received basis[25,26];much greater than 5,000 Btu/lb threshold. The ASR Fuel makes a useful

[23] 48 FR 11157-11160, March 16, 1983 – Identified as the low end of the woods fuel range of heating values which would not be considered sham recycling

[24] 76 FR 15541 (March 21, 2011), 78 FR 9172 (February 7, 2013), and various EPA Response & Clarification Letters ("Comfort Letters")

[25] Boughton, Robert. 2006. "Evaluation of shredder residue as cement manufacturing feedstock."

California Department of Toxic Substances Control.

[26] Cirko, Cathy. 1999. "Auto shredder residue potential fuel for steel mill blast furnaces."

contribution to the cement clinker manufacturing process which inherently requires substantial heat input to drive the process.

The proposed categorical non-waste fuel has a documented heat value in excess of 5,000 Btu/lb.

Legitimacy Criteria 3 – Contaminant Comparison – 40 CFR 241.3(d)(1)(iii)

To meet the comparable contaminants part of the NHSM rule legitimacy criteria, alternative fuels must be documented to have contaminant concentrations comparable to traditional fuels which the plant is *designed to burn*. "Designed to burn" means having a method to feed the fuel into the combustion system (e.g., a way to load solid fuel of a particular size into the unit). This method does not have to be permitted, but must be a part of documented system design.[27]

The overall set of contaminants subject to comparison between traditional fuels and alternative fuels include:

- 187 Hazardous Air Pollutants (HAPs) identified in Section 112(b) of the Clean Air Act[28]
- Nine (9) pollutants (PM, SO_2, HCl, NOx, CO, Pb, Cd, Hg, D/F) known to impact human health and the environment identified in Section 129(a)(4) of the Clean Air Act[29]
- PM is not considered for the NHSM rule and the metals and D/F are already listed as HAPs, so only HCl, nitrogen, and sulfur are additional contaminants considered

A list of 22 contaminants "known" by the U.S. EPA to be present in solid traditional fuels has been used to compare to the concentration ranges for each contaminant identified in the alternative fuels being considered. Attachment 1 provides analytical results for the proposed ASR being considered in this request. Contaminant concentrations in ASR Fuel are comparable to, or lower than, contaminant concentrations of the traditional fuels that GCC's Combustion Facility is designed to utilize[30]. GCC's kilns are all designed to utilize solid fuels, and each facility can additionally utilize liquid and/or gaseous fuels. Therefore, the table documents the traditional solid fuel range of values, and additionally lists the liquid and gaseous fuel values for constituents that have concentrations above the high end of the range for solid fuels.

Analytical results from ASR Fuel show that it is a beneficial replacement for traditional fuels in GCC's Combustion Facility. Sulfur content is typically very low. Chlorine content is such that the material will work efficiently in some, but not all cement manufacturing processes, similar to experiences with solid traditional fuel. The system design of the GCC Dacotah Combustion Facility incorporates a chlorine bypass circuit which allows fuels with elevated chlorine levels to be used efficiently. Mineral content of ash component has high concentrations of silica, iron and calcium, all of which are beneficial components in the cement manufacturing process. Minerals detrimental to cement manufacturing are negligible. Alkalis are lower than those for many traditional solid fuels.

Four compounds in the volatile organic compound group were detected in auto shredder residue fuel that are not reported in databases for traditional fuel, at very low concentration.

- Acetone has been detected at levels <1.0 mg/kg in ASR Fuel. Acetone is widely used in industry as a solvent, but is also commonly in everyday application. Acetone is used in the cosmetics industry as finger nail polish remover, in skin creams and makeup; as a gasoline additive to allow fuel to disperse more readily in the intake system; and in the environmental industry to dissolve sludges in oil spills. The U.S. Food and Drug Administration (FDA) has determined acetone is safe for use as an indirect food additive in adhesives and food-contact coatings and is regarded as a Generally Recognized as Safe (GRAS)

Canadian Chemical News, September 1, 1999
[27] 76 FR 80481 (December 23, 2011)
[28] https://www.epa.gov/haps/initial-list-hazardous-air-pollutants-modifications
[29] Particulate Matter (PM), Sulfur Dioxide (SO_2), Nitrogen Oxides (NOx), Carbon Monoxide (CO), Lead (Pb), Cadmium (Cd), Mercury (Hg), Dioxins and Furans (D/F)

[30] Compilation of information from USEPA's Contaminant Concentrations in Traditional Fuels: Tables for Comparison (11/29/2011), and the Materials Characterization Paper (2/7/2011).

substance at certain concentrations.[31,32] Acetone is a product of human metabolism, although its role in metabolic processes is not well understood.[33]

- *n*-Propylbenzene has been detected at levels <1.0 mg/kg in ASR Fuel. *n*-Propylbenzene is used as an additive in industrial, commercial and consumer paints and coatings.[34] It is not expected to pose any risk at the levels reported for ASR Fuel.[35]
- 1,3,5-trimethylbenzene and 1,2,4-trimethylbenzene have been detected at levels <1.0 mg/kg (combined) in ASR Fuel. Both *1,n,n*-trimethylbezene forms are used as additives in industrial, commercial and consumer paints and coatings.[36] 1,2,4-trimethylbenzene may also be present in fuel or oil and is isolated during the petroleum refining process.[37] Neither compound is expected to pose any risk at the levels detected in ASR Fuel .[38]

[31] 21 CFR §175.105(c)(5) "FOOD FOR HUMAN CONSUMPTION: Substances for Use Only as Components of Adhesives" (accessed 05 December, 2018).

[32] 21 CFR §175.320(b)(3) "FOOD FOR HUMAN CONSUMPTION: Substances for Use as Components of Coatings: Resinous and polymeric coatings for polyolefin films" (accessed 05 December, 2018).

[33] Kalapos, M. P. "Possible physiological roles of acetone metabolism in humans" *Medical Hypothyses* Volume 53, Issue 3, September 1998, pp 236-242.

[34] National Institutes of Health, U. S. National Library of Medicine, Chemical Information Database #7668 (CID: 7668).

[35] National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention, RTCES# DA8750000.

[36] National Institutes of Health, U. S. National Library of Medicine, Chemical Information Database #7668 (CID: 7947), (CID: 7247).

[37] NIH (CID: 7247) *ibid.*

[38] National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention, RTCES# OX6825000 (1,3,5-trimethylbenzene) and RTCES# DA3325000 (1,2,4-trimethylbenzene)

Table 1: Fuel Specification & Comparison of Auto Shredder Residue Fuel to Traditional Fuel Tables

Chemical Name	CAS Number	Units	Auto Shredder Residue Fuel Typical	Coal Range EPA/OAQPS Database	Liquid Traditional Fuel Range (ppm)	Coal Trad. Spec (ppm)	Liquid Trad. Fuel Spec (ppm)	Comparison of Auto Shredder Residue Fuel to Coal and Liquid Fuel
Metal Elements, ppm - dry basis								
Mercury (Hg)	7439-97-6	mg/kg	**0.22**	**ND-3.1**		**3.1**		Lower than coal
Cadmium (Cd)	7440-43-9	mg/kg	**2.99**	**ND-19**				Lower than coal
Lead (Pb)	7440-92-1	mg/kg	**37.6**	**ND-148**		**SVM 301.6**		Lower than coal
Selenium (Se)	7782-49-2	mg/kg	**0.1**	**ND-74.3**				Lower than coal
Arsenic (As)	7440-38-2	mg/kg	**<0.10**	**ND-174**		**174**		Lower than coal
Antimony (Sb)	7440-36-0	mg/kg	**0.4**	**ND-10**				Lower than coal
Beryllium (Be)	7440-41-7	mg/kg	**0.051**	**ND-206**				Lower than coal
Chromium (Cr)	7440-47-3	mg/kg	**9.85**	**ND-168**		**LVM 2,070**		Lower than coal
Cobalt (Co)	7440-48-4	mg/kg	**1.36**	**ND-30**				Lower than coal
Manganese (Mn)	7439-96-5	mg/kg	**44.2**	**ND-512**				Lower than coal
Nickel (Ni)	7440-02-0	mg/kg	**25.2**	**ND-730**				Lower than coal
Non-metal Elements, ppm - dry basis								
Chlorine (Cl)	7782-50-5	mg/kg	**1640**	**ND-9080**		**Halogens 11,573**		Lower than coal
Fluorine (F)	7782-41-4	mg/kg	**19.3**	**ND-178**				Lower than coal
Nitrogen	7727-37-9	mg/kg	**16,300**	**13,600-54,000**	**ND-150,000**	**67,500**		Lower than coal
Sulfur (S)	7704-34-9	mg/kg	**0**	**740-61,300**	**ND-150,000**	**76,625**	**187,500**	Lower than coal
Volatile Organic Compounds (VOC), ppm - dry basis								
Benzene	71-43-2	mg/kg	**0.036**	**ND-38.6**	**ND-75**	**38.6**	**75**	Lower than coal
Ethylbenzene	100-41-4	mg/kg	**0.017**	**0.7-5.4**	**22-1,270**			Lower than coal
Styrene	100-42-5	mg/kg	**0.220**	**1.0-26**	**ND-320**			Lower than coal
Toluene	108-88-3	mg/kg	**0.260**	**8.6-56**	**ND-380**			Lower than coal
Cumene	98-82-8	mg/kg	**ND**		**6,000-8,600**	**VOC 178**	**VOC 39,246**	ND
Formaldehyde	50-00-0	mg/kg	**ND**	**1.6-2.7**				ND
Hexane	110-54-3	mg/kg	**ND**		**50-10,000**			ND
Phenol	108-95-2	mg/kg	**ND**		**ND-7,700**			ND
Xylenes	1330-20-7	mg/kg	**0.710**	**4.0-28**	**ND-3,100**			Lower than coal
Naphthalene	91-20-3	mg/kg	**0.066**		**ND-7,330**			Lower than liquid fuel
Biphenyl	92-52-4	mg/kg	**ND**		**1,000-1,200**	**SVOC 2,613**	**SVOC 374,100**	ND
Polycyclic hydrocarbons		mg/kg	**0.066**	**14-2090**	**3,900-54,700**			Lower than coal

Contaminant concentrations found in this category of alternative fuels are comparable to or less than the concentrations found in traditional solid or liquid fuels utilized at Unit #9. A direct comparison of pre-combustion concentrations indicates that maximum concentrations found in the alternative fuel are generally an order of magnitude less than those found in the traditional solid fuels that a cement kiln is designed to burn. Thus, the alternative fuel satisfies the third legitimacy criteria defined in 40 CFR 241.3(d)(1)(iii).

When considering whether ASRs addressed by this request are non-wastes, the agency can be assured that the fuel value is being recovered without an increased environmental or health impact. Of primary consideration, emissions of the contaminants are inherently controlled or incorporated into the product in the cement manufacturing process. Kiln system at the Facility is already are subject to the PC MACT emission standards (40 CFR 63, Subpart LLL), regardless of fuel type (historically for all non-hazardous waste fuel). The PC MACT emissions limits include PM as a surrogate for metals emissions, THC as a surrogate for non-dioxin organic emissions, D/F, HCl, and Hg. As part of the most recent regulatory development process updating the LLL rules, U.S. EPA has demonstrated that the limits set forth in the PC MACT rules are technologically advanced and protective of human health and the environment. Priority pollutants and GHG emissions are also controlled through industry CAA regulation and industry initiatives to reduce emissions.

Moreover, unlike any other "combustors" identified in the CISWI and NHSM rules, the cement kiln system's primary function is to make quality cement product. As such, the cement manufacturer monitors what goes into the kiln system in order to ensure that the elements for the chemical reactions taking place are conducive to yielding a product that meets quality specifications. Constituents that are detrimental to the quality of the product or that do not contribute to providing energy are not welcome in the cement kiln system as alternative fuels and are avoided by cement manufacturers. Accordingly, the cement industry has spent decades studying and understanding the fate of constituents in the manufacturing process, and has developed an extensive body of knowledge about system inputs and emissions.

This industrial process is unique among "combustors" identified in the CISWI and NHSM rules due to the use of large quantities of raw materials and fuels that contain organic and inorganic constituents and the inherent operating characteristics of the system. The operating conditions used to make high quality cement utilize, as fuel or incorporate into the clinker, most of the potential air pollutants that are part of the fuels and raw materials. Some of these operating conditions include (World Business Council 2005):[39]

- High temperatures (2,700°F to 3,500°F)
- Good mixing – of fuels, raw materials, and gases
- High residence time – Although the specific residence times of the various kilns systems varies, combustion gases in the kiln systems are typically at temperatures greater than 1800°F for at least 3-5 seconds, which is a longer period of time than the typical incinerator (approximately two seconds). The residence time for solid materials at or above 1800°F varies from tens of minutes to more than three hours. Consequently, the various materials in the kiln have a significant amount of time to interact to assure good combustion.
- Ability to accommodate large variations in the complex mixture of minerals and metals that naturally occur in fuels and raw materials.
- Inherent scrubbing effect of materials in the process which results in potential air pollutants being adsorbed into the product.

The high temperatures in combination with sufficient residence times result in complete combustion of alternative fuels, such as starch, vegetable oil, wood chips, or other forms of biomass/organic material. These alternative fuels have chemical bonds that are broken by the high temperature and retention times of the system. The products of complete combustion are carbon dioxide (CO_2) and water.[40] Cement kilns have continually shown through decades of testing that the high temperatures and long residence times are conducive to fully utilizing the value in the alternative fuel.

[39] As published in PCA R&D Serial No. SN3083.
[40] As published in PCA R&D Serial No. SN3083.

CONCLUSION

The NHSM determination request for ASR covered in this letter is not wastes when managed and combusted for energy recovery in accordance with 40 CFR 241.4(b)(1). ASR is:

- not discarded or has been sufficiently processed, as necessary, and are managed in systems similar to traditional fuels,
- combusted for legitimate energy recovery,
- managed as valuable commodities,
- comparable to and have the same fuel characteristics as traditional fuels used at Unit #9, and
- used within a reasonable time frame.

Also, the combustion of ASRs at the Facility supports sustainability objectives promoted by U.S. EPA, reducing diversion of these streams to landfills and lessening air pollution due to use of cleaner alternative fuels in place of fossil fuel at combustion facilities. GCC respectfully requests U.S. EPA's review and concurrence of the submitted information in support of this determination request for a non-waste determination for ASR as NHSM fuel.

If you have any questions or comments about the information presented in this letter, please do not hesitate to contact me at janderson@gcc.com or (605) 721-7033 or Vineet Masuraha of Trinity Consultants at (949) 567-9880 x 101.

Sincerely,

GCC Dacotah

Jim Anderson
Environmental Engineer

Attachments

cc: Gina Lotito, GCC, gnance@gcc.com
Vineet Masuraha, Trinity Consultants, Inc., vmasuraha@trinityconsultants.com
Tracy Atagi, U.S. EPA, Atagi.Tracy@epa.gov

Attachment 1. Analytical Data

Fourth Quarter 2015
Automobile Shredder Residue (ASR) Analysis
Pacific Steel & Recycling
3385 Coulson Road, Billings Montana, 59101
Date Collected: 11/11/2015

PARAMETER	SAMPLE ID				
	PSR-A2	PSR-C3	PSR-C1		
TCLP VOCs - EPA Methods 1311/8260B (mg/L)				Average	RCRA Limits
Benzene	<0.0500	<0.0500	<0.0500	<0.0500	0.5
Carbon tetrachloride	<0.0500	<0.0500	<0.0500	<0.0500	0.5
Chlorobenzene	<0.0500	<0.0500	<0.0500	<0.0500	100
Chloroform	<0.250	<0.250	<0.250	<0.250	6
1,1-Dichloroethane	<0.0500	<0.0500	<0.0500	<0.0500	0.5
1,2-Dichloroethene	<0.0500	<0.0500	<0.0500	<0.0500	0.7
2-Butanone (MEK)	<0.0500	<0.0500	<0.0500	<0.0500	200
Tetrachloroethene	<0.0500	<0.0500	<0.0500	<0.0500	0.7
Trichloroethene	<0.0500	<0.0500	<0.0500	<0.0500	0.5
Vinyl chloride	<0.0500	<0.0500	<0.0500	<0.0500	0.2
TCLP Semi-VOCs - EPA Methods 1311/8270D (mg/L)				Average	RCRA Limits
1,4-Dichlorobenzene	<0.100	<0.100	<0.100	<0.100	7.5
2,4-Dinitrotoluene	<0.100	<0.100	<0.100	<0.100	0.13
Hexachlorobenzene	<0.100	<0.100	<0.100	<0.100	0.13
Hexachloro-1,3-butadiene	<0.100	<0.100	<0.100	<0.100	0.5
Hexachloroethane	<0.100	<0.100	<0.100	<0.100	3
Nitrobenzene	<0.100	<0.100	<0.100	<0.100	2
Pyridine	<0.100	<0.100	<0.100	<0.100	5
3&4-Methyl Phenol	<0.100	<0.100	<0.100	<0.100	400
2-Methylphenol	<0.100	<0.100	<0.100	<0.100	200
Pentachlorophenol	<0.100	<0.100	<0.100	<0.100	100
2,4,5-Trichlorophenol	<0.100	<0.100	<0.100	<0.100	400
2,4,6-Trichlorophenol	<0.100	<0.100	<0.100	<0.100	2

Bold – Analyte detected above minimum laboratory reporting limit.
NA – Sample was not analyzed for this analyte.

Fourth Quarter 2015
Automobile Shredder Residue (ASR) Analysis
Pacific Steel & Recycling
3385 Coulson Road, Billings Montana, 59101
Date Collected: 11/11/2015

PARAMETER	SAMPLE ID				
	PSR-A2	PSR-C3	PSR-C1		
PCBs - EPA Method 8082 (mg/kg) - Dry Weight				Average	TSCA Limit
Aroclor 1016	<0.260	<0.267	<0.263		
Aroclor 1221	<0.260	<0.267	<0.263		
Aroclor 1232	<0.260	<0.267	<0.263		
Aroclor 1242	<0.260	<0.267	<0.263		
Aroclor 1248	<0.260	<0.267	<0.263		
Aroclor 1254	<0.260	<0.267	<0.263		
Aroclor 1260	<0.260	<0.267	<0.263		
TOTALS	<0.260	<0.267	<0.263	<0.263	50
TCLP RCRA 8 Metals - EPA Methods 1311/6010B/7470A (mg/L)				Average	RCRA Limits
Arsenic	<0.450	NA	NA	<0.450	5
Barium	**1.96**	NA	NA	**1.96**	100
Cadmium	<0.450	<0.450	<0.450	<0.450	1
Chromium	<0.450	NA	NA	<0.450	5
Lead	**0.715**	**0.915**	**0.628**	**0.753**	5
Mercury	<0.100	NA	NA	<0.100	0.2
Selenium	<0.450	NA	NA	<0.450	1
Silver	<0.450	NA	NA	<0.450	5

Date: October 23, 2018

Date Received: 10/5/18
Matrix: Biomass/ASR

REPORT OF ANALYSIS

Sample ID: GCC-ASR 10/2/18

Ultimate Analysis	As Received wt%	Moisture Free wt%	Moisture & Ash Free wt%	ASTM Method	Date Analyzed	Analyst
Moisture	0.92	*****	*****	D7582	10/10/2018	ZB
Ash	4.80	4.84	*****	D7582	10/10/2018	ZB
Carbon	67.93	68.56	72.05	D5373	10/10/2018	ZB
Hydrogen	9.88	9.97	10.48	D5373	10/10/2018	ZB
Nitrogen	1.63	1.65	1.73	D5373	10/10/2018	ZB
Sulfur	0.00	0.00	0.00	D4239	10/10/2018	ZB
Oxygen	14.84	14.98	15.74	calculated		
Total	100.00	100.00	100.00			

	As Received Btu/lb	Moisture Free Btu/lb	Moisture & Ash Free Btu/lb	ASTM Method	Date Analyzed	Analyst
Heating Value	16,061	16,210	17,035	D5865	10/10/2018	ZB

Hydrogen and Oxygen values reported do not include hydrogen and oxygen in the free moisture associated with the sample.
Reported results calculated by ASTM D3180. Results are an average of 2 runs.

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Date: October 23, 2018

Date Received: 10/5/18
Matrix: Biomass

REPORT OF ASH ANALYSIS

Sample ID: GCC-ASR 10/2/18

	Wt. % Ignited Basis	Method	Date Analyzed	Analyst
Silicon Dioxide, % as SiO2	39.71	XRF	10/12/2018	CW
Aluminum Oxide, % as Al2O3	6.38	XRF	10/12/2018	CW
Iron Oxide, % as Fe2O3	12.15	XRF	10/12/2018	CW
Calcium Oxide, % as CaO	14.44	XRF	10/12/2018	CW
Magnesium Oxide, % as MgO	10.59	XRF	10/12/2018	CW
Sodium Oxide, % as Na2O	1.51	XRF	10/12/2018	CW
Potassium Oxide, % as K2O	0.72	XRF	10/12/2018	CW
Titanium Dioxide, % as TiO2	3.53	XRF	10/12/2018	CW
Manganese Dioxide, % as MnO2	0.19	XRF	10/12/2018	CW
Phosphorus Pentoxide, % as P2O5	0.36	XRF	10/12/2018	CW
Strontium Oxide, % as SrO	0.09	XRF	10/12/2018	CW
Barium Oxide, % as BaO	0.61	XRF	10/12/2018	CW
Sulfur Trioxide, % as SO3	2.61	XRF	10/12/2018	CW
Chlorine, Cl	1.95	XRF	10/12/2018	CW
Nickel Oxide, NiO	0.28	XRF	10/12/2018	CW
Copper Oxide, CuO	0.55	XRF	10/12/2018	CW
Zinc Oxide, ZnO	3.37	XRF	10/12/2018	CW

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End of Report
MLE/tab

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Date: October 23, 2018

Date Received: 10/5/18
Matrix: Biomass

REPORT OF ANALYSIS

Sample ID: GCC-ASR 10/2/18

	Result	Units	Method	Date Analyzed	Analyst
Beryllium	0.051	mg/kg	EPA 6020	10/18/18	MLE
Chromium	9.85	mg/kg	EPA 6020	10/18/18	MLE
Manganese	44.2	mg/kg	EPA 6020	10/18/18	MLE
Cobalt	1.36	mg/kg	EPA 6020	10/18/18	MLE
Nickel	25.2	mg/kg	EPA 6020	10/18/18	MLE
Arsenic	< 0.1	mg/kg	EPA 6020	10/18/18	MLE
Selenium	0.10	mg/kg	EPA 6020	10/18/18	MLE
Cadmium	2.99	mg/kg	EPA 6020	10/18/18	MLE
Antimony	0.40	mg/kg	EPA 6020	10/18/18	MLE
Mercury	0.22	mg/kg	EPA 6020	10/18/18	MLE
Lead	37.6	mg/kg	EPA 6020	10/18/18	MLE

Water Soluble Sodium	6.78	mg/kg	EPA 6010	10/17/2018	CB
Water Soluble Potassium	11.3	mg/kg	EPA 6010	10/17/2018	CB
Chlorine	0.164	wt.% Dry basis	XRF	10/12/2018	CW
Fluorine	19.3*	mg/kg	ASTM D3761	10/11/2018	MLE

*Results are an average of 2 runs.

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End of Report
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Date: October 23, 2018

Date Received: 10/5/18
Matrix: Biomass

QUALITY CONTROL

Parameter	Reference Material	Expected	Result	% Recovery
Ash	AR2775	6.80	6.44	95
Sulfur	AR1704	1.04	1.04	100
Carbon	hs-100062	65.6	63.8	97
Hydrogen	hs-100062	6.69	6.80	102
Nitrogen	hs-100062	8.50	8.86	104
Heating Value	Benz 1	11,373	11,391	100
Beryllium	ERA 4286	0.253	0.225	89
Chromium	ESI QC	0.891	0.916	103
Manganese	ESI QC	1.78	1.74	98
Cobalt	ESI QC	0.349	0.408	117
Nickel	ESI QC	0.801	0.892	111
Arsenic	ESI QC	0.688	0.600	87
Selenium	ESI QC	0.124	0.114	92
Cadmium	ESI QC	0.132	0.106	80
Antimony	ESI QC	0.616	0.600	97
Mercury	ERA Hg QC	0.006	0.005	83
Lead	ESI QC	0.546	0.614	112
Sodium	ESI QC	50.0	52.3	105
Potassium	ESI QC	50.0	53.9	108
Chlorine	NIST 1632C	0.114	0.116	102
Fluorine	ESI QC	5.00	5.21	104

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End of QC Report
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